

SCIENCE

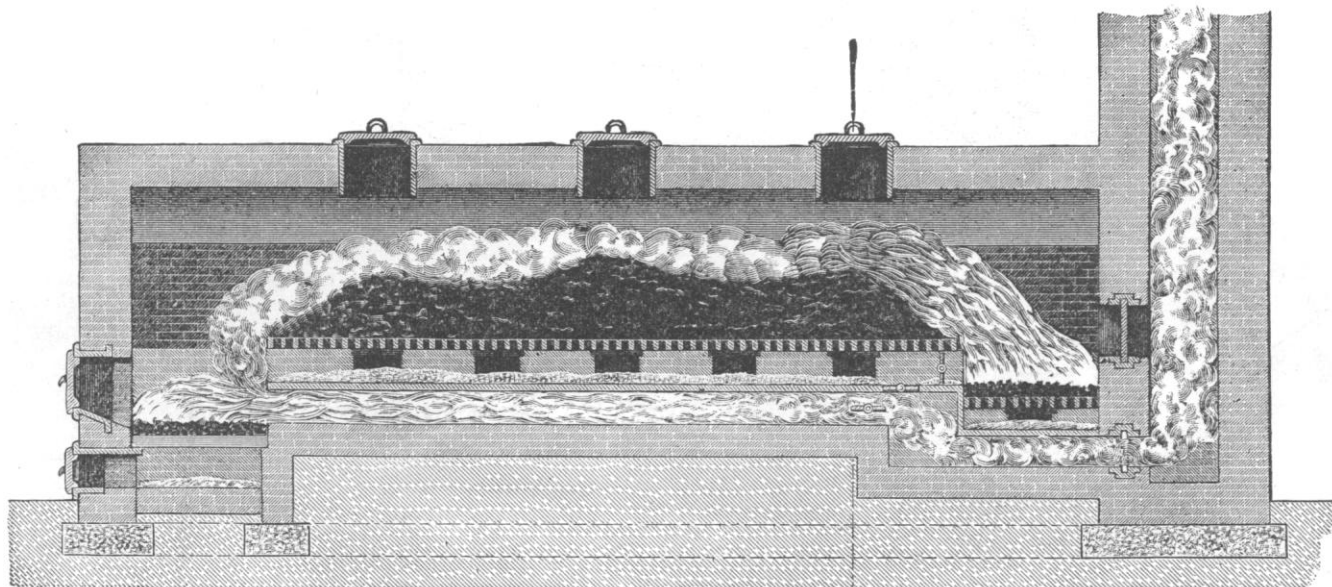
FRIDAY, DECEMBER 7, 1888.

GARBAGE-CREMATATION.

IF we may judge from the discussions of the American Public Health Association for the past two years at its annual meetings, the most important practical sanitary problem of the time is how to dispose of the garbage and night-soil of populous communities. For cities situated on the seaboard this question is not such a pressing one, as the refuse can be transported by water sufficiently far from the shore, and deposited in the ocean. If it returns on the incoming tide, and is cast on the beach, this may in the future be avoided by carrying it still farther. But to inland towns and cities no such method is available. For years many of these have cast their waste into the river, if such ran near them, or to a general

ducts from the substances being cremated complete the process of burning, the substance thus in great part supplying the fuel for its own destruction.

The following description and cut of the garbage-furnace which was erected at Des Moines, Io., will make clear the method by which Mr. Engle adapts this principle to practice. The cut presents a vertical longitudinal section of the furnace, showing its forward end toward the left. The upper door shown in the left-hand end opens into the fireplace, and the door immediately below opens into the ash-pit thereunder. The five larger openings shown on the side of the furnace midway of its length open into the ash-pit under the grate, which supports the garbage and other wet and offensive substances which are being burned. Five smaller doors above open into the garbage fireplace in order to give easy access thereto, in case it becomes expedient to stir or otherwise move the



VERTICAL LONGITUDINAL SECTION OF THE DES MOINES GARBAGE-FURNACE.

dumping-place near by, and were content to know that they at least were relieved of the burden, caring little that their sister cities, situated farther down the river, were injuriously affected. Not until a direct detriment either to a city's health or financial prosperity can be traced to such methods, is there a disposition to invoke the aid of sanitary science and the ingenuity of the inventor. The rapid growth of interior towns in the United States has made some radical method of the disposition of such material an absolute necessity, and, by the common consent of all sanitarians, no method offers such advantages as its destruction by cremation.

Of the many devices which have been invented for the conversion of noxious waste into a harmless residue through the instrumentality of fire, none seems to have more effectually accomplished the object than the Engle cremator. The principle involved in the invention resides in the use of two fires at the opposite ends or sides of the garbage or other substances to be burned; and in managing the fires so that one of them operates to volatilize the liquid constituents of the substances, while the other operates to burn the steam and other gases which arise from the volatilization; and then in so managing the fires as to complete the process of burning the dry residuum, or reducing it to a fertilizer, if so desired. The economy of the process, aside from the simplicity and low cost of the furnaces, lies in the fact that comparatively little coal or other fuel is required to start the two fires. The gases and other prod-

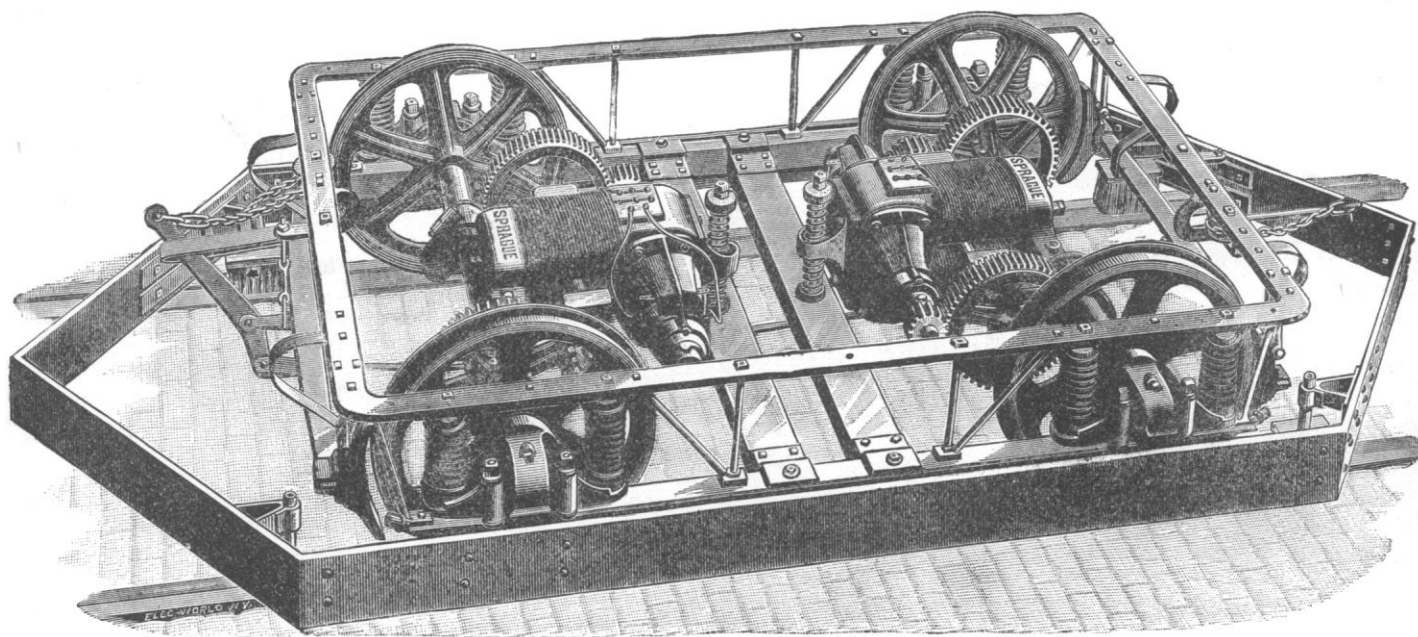
garbage in the fireplace while it is being consumed. There are also openings into the rear fireplace, and into the pit under it. Three angular valve-handles operate the three valves which appear in the figure to the left of the rear fireplace. The two valves which appear in the figure give egress into the chimney from the first fireplace and the second fireplace respectively. The three covers on the top of the furnace close the downward openings in the top of the furnace, through which the matter may be dumped upon the grate.

The mode of operation is as follows: The garbage and matter to be consumed are dumped upon the garbage-grate, and a fire of coal is made in each of the two fireplaces at the respective ends of the furnace. The flames from the rear fireplace pass over the garbage, driving before them the steam and other gases arising therefrom into the flames above the forward fireplace, where the flames from the two furnaces meet and mingle. As those mingled flames pass backward toward the chimney, they intensely heat the iron floor of the garbage ash-pit, and that floor conducts heat upward toward the garbage above it, and thus aids in volatilizing the liquid constituents thereof. This operation continues until the substances on the garbage-grate are reduced to a dried condition, when the lower chimney-valve may be closed and the upper chimney-valve opened; and thereupon the flames will pass from the forward fireplace above the garbage-grate, and ignite the dried sub-

stances resting thereon, and drive the products of the resulting combustion into and through the flames above the rear fireplace.

Health Officer Thompson of Chicago visited Des Moines to inspect the working of the garbage-crematory there, and in his report says, "The cost of the operation is much less than at the Montreal furnace. The device is simple, but it is as effective as any I know of. It does not need skilled labor, and does not use much coal. Two men seemed to be able to do the work there that ten did in Montreal. This furnace was built by Mr. James Callanan, a wealthy Des Moines citizen, to demonstrate what could be done in the way of disposing of garbage quickly and completely without offensive smell, and it is attracting attention all over the country. . . . I think myself that the Des Moines one is the best, and it is much the cheapest, and I am in favor of putting up our first one upon that plan." He further says there were thrown into the furnace while he watched it two dead horses, seven dogs, eighteen barrels of garbage, three hods of manure, fifteen bushels of rotten eggs, and three barrels of rotten fish. This was all consumed in one hour, with no offensive smell from the combustion, and no smoke. The furnace was cold when started.

The Des Moines *Leader* thus speaks of the Engle cremator:



NEW SPRAGUE TRUCK FOR STREET-CARS.

"The especial advantage of this apparatus is that it may be located in any part of the city without any offence. It is the invention of Andrew Engle of Baxter, Io., who also invented the process of destroying the filth of closets in houses by fire, which process, when once in general use, will avoid the necessity of polluting streams and lakes with dead-sewage. A furnace built for this purpose has been in use in the old Capitol building at Des Moines for the past three years. It has given complete satisfaction, and demonstrated its adaptability for hotels, public buildings, and private residences."

The Engle Company erected one of their crematories, twenty feet long, in September of this year, at West Brighton, Coney Island, and had it in use until the close of the season, giving such satisfaction to the town authorities as to induce their hearty recommendation of its merits as being economical, scientific in principle, and cleanly and efficient in its methods of disposing of the refuse, and seemed to them the best means for the treatment of such nuisances.

One of these furnaces has just been erected at Milwaukee, Wis., and was put into operation during the recent meeting of the American Public Health Association in that city, and inspected by many of the members.

It is claimed for this furnace that it is not only applicable to large cities, but to almost every collection of human beings, even to a single family living in a private dwelling. The inventor says that

its use is indicated in private dwellings in any locality in the country or city, but especially in all places where no system of water-works is in operation, and also in villas and suburban places, where there may be a private water-system, but where drainage is into cesspools or small streams. The great majority of dwellings in the United States have neither water-closets, cesspools, nor drainage, and have none but the most cumbrous and inadequate method of coping with the great evil. The very low cost of the small furnaces brings it within the means of those who occupy the smallest class of houses, and its feasibility has been demonstrated for tenement-houses and for blocks of buildings in towns, as well as for detached houses.

For seaside or mountain resorts, where sanitary measures are more and more demanded by the public, this system affords the means of answering the demand, and will add to the popularity and desirability of such resorts by removing the great dread which city people have of typhoid and malarial poisoning. They can be placed in the basement or cellar, or in outhouses built for the purpose, wherever they can be connected with a chimney for draught and ventilation.

These furnaces are themselves the receptacle or vault, and no dis-

infectants or absorbents are needed, and no removal or handling. When fired, the valves are closed until the cremating process, lasting about an hour, is over. No skill beyond ordinary intelligence is required for the management of the fire or the apparatus.

For schoolhouses, large or small, it is believed this furnace will remove the greatest menace to the health of the children, and be a long step toward decency and comfort.

For factories or other establishments, and for military barracks; for railroad-stations, for camp-meeting or picnic grounds, and for all other collections of summer-houses; for county court-houses, jails, and other public institutions in city or country; for hospitals and prisons,— this system will be found to have advantages.

THE NEW SPRAGUE ELECTRIC-MOTOR TRUCK.

WE take pleasure in presenting our readers with a view of the new electric-motor truck, constructed by the Sprague Electric Railway and Motor Company of New York. This truck is the same that was exhibited by the Sprague Company at the last street-railway convention at Washington, and one which attracted such wide attention and admiration there.

This truck is complete in every detail, and carries two powerful 15-horse power motors of a new design, and of the finest workmanship. Every detail of mechanical and electrical construction

is carefully attended to, and the most recent improvements which experience could suggest, have been adopted to meet the exigencies of street-car service.

The motors have the regular Sprague mounting, as shown in the illustration, being centred on the axles, and flexibly supported to prevent accident from sudden strain. They are very compact and powerful, and combine the requisites of lightest weight possible with highest efficiency. Without this flexible suspension for both directions of running, it is hard to imagine how a motor can be successfully applied to street-cars and fulfil all conditions of actual experience.

Only one intermediate is used between the armature pinion and the main gear. The gear upon the intermediate, which meshes into the main gear, is built of vulcanized fibre, making it absolutely noiseless, is so constructed that it is very durable, and it will out-wear the steel teeth which mesh into it.

All the bearings are self-oiling and completely dust-proof, and should run at least a month with little or no attention, and each is so constructed that it can be removed without dismounting the machine. The brushes are on an entirely new principle and design, and are remarkable for ease of adjustment, and work with equal facility in running either forward or backward. By their means a perfect electrical contact is secured, without excessive pressure on the commutator, and all wear is reduced to a minimum.

The whole motor and the gearing, and all parts, are so placed that they can be perfectly shielded and shut in by a tight-fitting cover, so that by this means it is rendered impossible for moisture or dust to get into any of the working parts.

The design and construction of every part of this truck are not only to have each detail as strong as possible, but also to have it readily accessible, and to reduce all care and attendance to a minimum.

We congratulate the Sprague Company upon the success which has attended their installations in the past, and we anticipate for them an increased success in the future.

SCIENTIFIC NEWS IN WASHINGTON.

How Birds soar: the Conditions of the Atmosphere, and not a Peculiar Structure of the Bird, the Essential Factor. — How Men of All Ages and in Every Country have made of Themselves Beasts of Burden. — How the Navajo gamble.

The Soaring of Birds.

WHOEVER has watched an eagle or other soaring bird as he circles through the air has marvelled that he is able to sustain himself without the flapping of his wings. Not only does he do this, but he rises higher and higher from the earth, enlarging his circles and seemingly increasing his speed, until he attains so great a height as to be almost invisible. This apparent defiance of the laws of gravitation has long been recognized as a problem to be solved, and many explanations have been offered. The latest contribution to the subject is by Mr. G. K. Gilbert, who read a paper to the Philosophical Society of Washington at its last meeting. He concluded by saying that when he proposed to the society's committee to place the paper on its programme, he supposed his theory of soaring to be novel, but that he had since found himself anticipated by Lord Rayleigh, who communicated the same explanation to *Nature* in 1883 (vol. xxvii. p. 534), and by Mr. Hubert Airy, who independently reached the same result at about the same time (*Nature*, vol. xxvii. p. 590). It appeared, however, from the informal discussion which followed the reading of the paper, that the earlier presentation of the theory had escaped the attention of many ornithologists and physicists present, and it may therefore not be amiss to restate it in the pages of *Science*. The following paragraphs are extracted from Mr. Gilbert's paper.

"The soaring bird, with wings expanded, is formed so as to move forward with little friction, and downward with great friction. We may conceive him as having two coincident motions, — a forward motion, initiated by muscular action; and a downward motion, slow but continuous, under the pull of gravity. By variations of the attitude of his wings and tail, he can and does control the direction of his forward motion.

"If the forward component of motion is horizontal, the resultant of the two motions is obliquely downward. In order that the resultant may be horizontal, it is necessary (1) that the forward component be directed obliquely upward, and (2) that it exceed a certain minimum amount.

"However small may be the friction created by the forward motion, it is not *nil*. It constantly tends to check the motion; and, unless the energy it consumes is in some way replaced, the forward motion is eventually so reduced that horizontal motion cannot be maintained.

"It is proposed to show that the needed compensatory energy may be derived from the differential motions of the air.

"I shall not dwell on the utilization of upward currents of air. It is evident without explanation that when a bird sails through air that is rising, whether vertically or obliquely, he is carried upward with the air, and, if the upward motion of the air equals or exceeds the downward motion of the bird under gravity, he does not need to flap his wings in order to sustain himself. But such opportunities are of exceptional occurrence; and, while it is highly probable that they are not neglected, recourse to soaring is too frequent, and with certain species too generally successful, to permit us to believe that an upward current is its necessary condition. I shall confine my attention to the less obvious resource of horizontal currents.

"It is frequently observed that the velocity of the wind increases from the ground upward. Let us assume, for simplicity's sake, that the air-currents above and below a certain horizontal plane have the same direction but different velocities, the upper moving the faster by a certain amount, z . A soaring bird is moving through the lower air in the opposite direction, and the bird's velocity with reference to the air is V .

"It should be borne in mind that velocity is merely rate of relative motion. Fully to define the velocity of a body, it is necessary to state to what other body its motion is referred. In this case the velocity of the upper current with reference to the lower current is z ; the velocity of the bird with reference to the lower current is V ; and, since the bird and the upper current pass the lower current in opposite directions, the velocity of the bird with reference to the upper current is $V+z$.

"Now let the bird change his course, turning obliquely upward and passing into the upper current. His velocity with reference to the air in which he is immersed is at once increased from V to $V+z$. Next let the bird wheel, to the right or to the left, until the direction of his motion is coincident with that of the wind. His velocity with reference to the upper current is still $V+z$, but the reversal of his direction has changed his relation to the currents. He is passing the lower and slower current more rapidly than he passes the upper, and his velocity with reference to the lower current is greater by their difference: it is $V+2z$. Now let him descend obliquely, and enter the lower current. His velocity is not affected by the transfer. It is still $V+2z$, referred to the lower current. Finally let him wheel in the lower current until his direction is once more directly opposed to that of the wind. The cycle of evolutions leaves him with the velocity $V+2z$, referred to the lower current, in place of his initial velocity V , referred to the same datum. He has gained a velocity $2z$, or double the velocity of one air-current referred to the other, and he has resumed his original relation to the currents. Manifestly he can repeat the process indefinitely.

"Add now that the velocity thus gained is the required compensation for the velocity lost by friction, and the essence of the theory is stated."

Mr. Gilbert then proceeded to pass from the special case assumed for the sake of simplicity to the more general case, pointing out that certain assumptions which facilitated the statement of the theory were not essential to the analysis. Provided the air in the region traversed by the bird has some differential motion in a horizontal sense, and provided the bird regulates his circling course so as to ascend when his direction of flight is opposed to the direction of the differential motion of the air into which he rises, and so as to descend when the relations are reversed, he will acquire from the differential motion of the air an acceleration of his own velocity. If this acceleration is less than the concurrent loss by fric-

tion, he cannot sustain himself by soaring alone; but, if it equals or exceeds that loss, he can sustain himself indefinitely.

After a discussion of various qualifying factors, it was stated that when the orbit of the bird is circular, and lies in an inclined plane rising toward the wind, and when the horizontal velocity of the air diminishes uniformly from the highest point to the lowest point of the orbit, the velocity gained by the bird in making the circuit is equal to the differential velocity of the highest and lowest layers of air traversed, multiplied by $\frac{\pi}{2}$ into the cosine of the angle of inclination of the plane of the orbit.

It was especially insisted that the theory does not propose to make something out of nothing, but appeals to a transformation of existing energy. "The differential motion of air-currents is a true store of solar energy, and the circling of the bird through the two currents enables him to draw on that store. The process is essentially homologous with the utilization of the relative motion of air and ocean for the sailing of a ship, and with the turning of a mill or the flying of a kite by means of the relative motions of air and ground or of air and boy; only in the case of the bird the apparatus is not in continuous contact with both members of the motive couple, but passes to and fro between them. The function of the kite-string is performed by the inertia of the moving bird."

It is evident, that, if this explanation is sufficient, soaring is impossible without differential motions of air, and is therefore impossible when the air has no motion; if it is sufficient, the circling of soaring birds is not merely habitual, but necessary; and if it is sufficient, observation should show that their circles are higher on one side than on the other.

Human Beasts of Burden.

Prof. Otis T. Mason has been many years engaged in the collection of material for a monograph or book upon the subject given above, and now has, systematically arranged, descriptions of several hundred different modes by which human beings, in civilized and savage countries, make themselves the vehicles for the transportation of burdens. Each of these he has had illustrated by a drawing, so that the whole is not only of the highest ethnologic value, but will be exceedingly interesting to the non-scientific reader.

At the last meeting of the Anthropological Society of Washington, Professor Mason read a paper in which he described some of the more common ways in which man has made himself a beast of burden. The brief abstract given here presents some of the more salient parts of the paper.

In his prefatory remarks, Professor Mason explained that this was a subject that had awakened his deepest interest, and that the paper he presented was but an introduction to other researches by means of which he proposed to fully investigate and demonstrate the growth of commerce as carried on through the agency of the human body. That the aboriginal inhabitants performed great feats in the way of transporting materials is shown by the co-existence of raw copper on the shores of Lake Superior, and manufactured copper implements in the remains of the mound and cave dwellings in the southern part of the country. The same thing is true of the presence of wrought jade, which is found in China and in the Swiss lake-dwellings. Men and women were the first beasts of burden, and it is undoubtedly true that all aboriginal carrying was done on their heads and backs.

Even the improved state of civilized society has not extinguished all traces of this, for human carriers are still numerous. Hod-carriers have but recently, and indeed but partially, been superseded by elevating machines. The great progress of the time has been such, continued Professor Mason, that no one walks nowadays unless it is a preferred exercise: horses, steam, and electricity lend their aid to whirl people to their destinations. It is considered vulgar to carry a parcel: the humblest servant-girl, buying a few cents' worth, may have her purchase taken home in a special-delivery wagon covered with forty coats of lacquer. It has been calculated that two million tons are constantly worn by the human race in the way of dress and ornament.

The paper then enumerated the various methods by which the various beasts of burden perform their carrying-tasks; first of all,

the hand, — the right hand. In speaking of this, Professor Mason said that he has examined a great number of savage implements designed to be carried in the hand, and that the proportion of those shaped for use by the left hand was not greater than 1 to 50. In no case did he find a left-hand female implement. Then both hands are used, after which the fingers come into play. As an illustration of the use of the fingers in carrying, Professor Mason mentioned the summer-resort waiter, who bears his tray aloft on three fingers. The baldric is next in order, slung over the shoulder by a strap, and hanging on the hip. In this way hunters carry game, and travellers carry small satchels. Then, still progressing, goods to be carried are hung to a belt. Hanging things on the arm may be called the retail method of carrying, and is used by farm-hands, servants, porters; in fact, by a large proportion of the people we meet in any place. While a civilized being will twist his form so as to get the load that is hung on his arm supported by his back, a savage will never be found doing so. Next comes the hanging over the shoulder, of which a good example is the universal sack of the negro vagabond, containing unclaimed property and other people's chickens. This method is used by grain-porters and hod-carriers.

The Oriental porters carry almost exclusively on their shoulders. A cooly's average load is a hundred pounds, with which he can make thirty miles a day. It is estimated that there are a million tons of material moved by coolies in China each day. Then both shoulders come into use, the load being placed round the neck; after which an easy progression is to the back, which is the natural carrying-place of the burden. The soldier, carrying his knapsack and rations, is a good example. Then loads are carried on the heads, — a process called 'toting.' The negro is a domestic example, and dairy-maids are reputed to carry their milk-pails on their heads, and there are many other illustrations of this mode of transportation. Certain tribes of Indians wear straw rings on their heads to aid in bearing and balancing these great loads. Pockets, remarked Professor Mason, are scarcely worth mentioning as a civilized means of transportation, although the flowing robes of a Chinaman are capable of concealing at least half a bushel of playing-cards, — a capacity that deserves passing notice.

The carrying-power given by these various modes is augmented by means of combinations of men, in illustration of which the vast works in Egypt and other Eastern countries were cited. Men also carry goods by traction; that is, by drawing over the ground. First the arm alone is used, then a line is fastened to the object and to the person. It is held in the hand over the shoulder, or wound over the waist or over a pole. The hunter drawing home his game is a primitive example of this means of carrying. Throwing is sometimes resorted to as a mode of transportation, of which the negro method of handling watermelons by tossing them from hand to hand is a fair example. Dirt and excavated material were at first carried in sacks, which have been superseded by shovels. The great necessities and the differentiating processes of civilization for rapid and safe transportation give rise to the professional carriers, among whom may be mentioned carriers, messengers, mail-men, and pedlars. For much of this excellent abstract, *Science* is indebted to the Washington *Evening Star*.

A Queer Game among the Navajo.

'Navajo Gambling Songs' was the title of a paper read by Dr. Washington Matthews at the last meeting of the Anthropological Society of Washington.

The Navajo Indians, he said, have numerous songs, many of which are sung during the progress of a gambling game called 'kesichay' (this spelling, Dr. Matthews afterward explained, will suffice). The game is founded on a myth which forms one of the traditional beliefs of the Navajo. The songs used in this game are almost numberless; and one old man of whom the doctor asked the number, said, with an intended exaggeration, that there were over four thousand in the game. Another said that there was a song for every bird that flies, every animal that crawls or prowls.

The game is sacred, and is usually played in winter, and always in the dark hours. When asked why the night should be selected for the game, one Indian remarked that "he on whom the sun shines while playing the kesichay will be stricken blind." The

game is played in a lodge or wigwam. Six moccasins are buried with their tops even with the ground, in two rows several feet apart, and filled to their edges with sand.

The Indians divide into two parties, and draw lots for the first move. The winners of the move take a small black stone, and, raising a blanket between themselves and their opponents to conceal their operations, hide the stone in one of the moccasins, burying it in the sand so that it is entirely out of sight. The others then try to find the stone by striking with a stick the moccasin supposed to contain it. If they find it, they take the stone in turn and hide it, the others guessing; but if they fail, their opponents hold it until it is found, each time hanging up the blanket, and changing, or pretending to change, its location. The game is counted by means of a hundred and two long slender sticks on each side, which change hands as the sides win or lose. The system of counting is very intricate, the count depending upon the location of the ball. Four, six, or ten counters change hands at each hiding. The chances are almost all in favor of the holders of the ball; and frequently one side will lose all of their counters before the ball is found, when the game comes to an end. Two of the counters on each side are notched, and are called 'grandmothers.' When there has been a long run of bad luck, the 'grandmothers' are stuck up in the ground and told to go and seek their grandchildren, meaning to bring back the luck and the lost counters. It is supposed to be lucky to hold the 'grandmothers' until the last: so they are not laid out until the others are all gone.

The myth on which the kesichay is founded is based, like most other Indian traditions, upon the sayings and doings of animals in those ages when the world was supposed to be peopled entirely with beasts. There were some animals, the tradition runs, that saw better, hunted better, and were happier, in the light, and others that liked the dark. As it was thought wise that the existing alternation of night and day should be changed so as to suit one or the other of these classes, it was determined to call a council of the animals to determine in whose favor the change should be made. When all were together, they decided to play the kesichay to settle the controversy. The council was held at night, and the game progressed with varying success for many hours. During the play the animals of either side began to sing songs illustrative of their luck or their feelings, sometimes taunting each other with their ill success. Every animal present sang of his own characteristics, and so the foundation of the present animal songs of the kesichay was laid. When the blanket is put up, the holders of the ball sing a chant to the effect that "the old screen hangs in front, the old screen hangs in front," repeated many times. The bear, the dog, the owl, every bird and animal known to the Navajo, has some appropriate song that is sung in the game.

The game between the nocturnal and the diurnal animals developed into a round of taunting songs, flung from one side to another, until some one called on the raven. He sang a song of the morning, and cried that the dawn had come, when the eastern sky began to be filled with light; and with a mingled cry of disappointment the nocturnal animals fled to their homes, scattering the articles used in the game, which was thus brought to an undecided end. For this reason the alternation of night and day has never been changed.

The moccasins used belonged to the bear, who, in his hurry, put them on wrong, thus giving his feet their peculiar shape. The sun shone on him before he reached his den, and turned his black coat to a reddish brown, which is its color now.

A Navajo Indian will not kill a snake, but, if one is encountered, will put a stick beneath it and toss it away: so, if a snake come into the tent where the kesichay is being played, it is tossed from one side to the other by the opponents, in the hope that it will bring bad luck to those with whom it stays.

ELECTRICAL NEWS.

The Use of Condensers in distributing Electricity.

Two patents have been lately issued in which condensers are employed to reduce from a high to a low potential, in place of transformers or storage-batteries. One of these plans has been already described in this journal, and an objection to it was pointed

out. Briefly, it consisted in charging a condenser of comparatively small capacity to a high potential, discharging it into a much larger condenser, thereby decreasing the potential, and finally discharging the latter through the lamp-circuit. This operation was continuously and rapidly performed. One objection that was pointed out lay in the great capacity that would be required for the large condenser. Another objection lies in the great waste of energy. The energy of the smaller condenser before it is connected with the larger is

$$\frac{1}{2} \frac{m^2}{c},$$

where m is the quantity of electricity on it, and c is its capacity. After it is discharged into the larger condenser, the energy of the two is

$$\frac{1}{2} \frac{m^2}{c+c_1},$$

where c_1 is the capacity of the latter. If we wish to reduce our potential from 2,000 volts to 100, c_1 must be 19 c , and the energy in the last case is only one-twentieth of that in the first, the difference having appeared as heat in the conductor connecting the two condensers. We have, in fact, an efficiency of only five per cent.

Another condenser apparatus for reducing from a high to a low potential has been patented by W. J. McElroy. The groups of sheets of which the condenser is made are of two sizes, the smaller size being connected with the main line, while the larger are connected through the lamp-circuit with the earth. The main line is supplied by an alternating current. The inventor describes the result as follows: "The electro-motive force available for the consumption circuit is easily regulated or set by the relative sizes of the sheets in the respective sides of the condenser, — the larger the difference, the lower the induced electro-motive force, — and the number of sheets will depend on the current strength needed for the particular circuit supplied. . . . For example: if it be desired to carry on the main line a current of 1,000 volts, and to supply a current on the consumption lines of 100 volts, then the size of the sheets on the one side must bear the proper proportion to those at the other side."

If we consider for a moment what the potential of the sheets on the consumption side will be, we see, in the first place, that, if they are not connected in any way with the earth, their potential will be that of the high-potential plates. If they are directly connected with the earth, their potential will be always zero, and, according as they are connected to the earth through a high or low resistance, their potential will be high or low. As for the increased size of the sheets connected with the lamp-circuit, it has nothing at all to do with the phenomenon, and the effect would be approximately the same if they were reduced to the size of the small sheets. It would not be difficult to calculate whether the system would regulate itself, but it is hardly in place here. Some of the objections to it, outside of the question of regulation, lie in the size of the condensers required, and in the fact, that, if only a few lamps are in use, it would be almost as dangerous to touch the lamp-circuit as the dynamo-circuit.

THE ACTION OF ELECTRICITY ON THE VESICLES OF CONDENSED STEAM. — M. J. L. Soret describes the following interesting experiment in the *Archives des Sciences*: In a dark room a platinum cup containing water is placed on a metal support, which is connected with one pole of a Tople machine. Above this cup a metal point is placed, which is connected with the other pole of the machine. A Bunsen burner boils the water in the cup, which is powerfully illuminated by the projection of a large pencil of the electric light. As long as the Tople machine is at rest, the vapor vesicles ascend in the ordinary way; but, as soon as the machine is at work, the action of electricity on the vapor is manifested in a most striking manner. For a certain distance from the point to the surface of the water the clouds collect, and whirl along the edge of the cup; under the influence of the electric light, they look to a certain extent like flames. If the point is brought a little nearer the water, the vapor disappears completely, although the water continues to boil briskly.

COMMELIN, DESMAZURES, AND BAILHACHE STORAGE-BATTERY. — M. Reymer, in his recent work, 'L'accumulateur Vol-

taïque,' describes this novel and promising battery. The positive electrodes are porous plates made by submitting finely divided copper to a pressure of 600 kilograms per square centimetre. The negative electrodes are tinned iron plates, which are amalgamated, the object of the tin being to hold the mercury, which does not adhere to iron. The receptacle is made of tinned sheet steel. The negative electrode rests on the bottom of the box, with which it is in contact. The following table shows the composition of the electrolyte:—

Water.....	1,000.00
Zinc.....	144.67
Potash in solution.....	209.82
Potash, free.....	313.72

The positive electrodes are enveloped in parchment paper, and are insulated from the negatives by glass rods. Without the parchment, the action is irregular, the oxidation of the positive is not complete, and deposits of zinc are mixed with the copper: hence want of adherence, and local action or short circuits through the formation of 'trees,' as in other batteries where metallic deposition takes place. The following data are the results of tests made in the laboratory of the inventors:—

Weight of cell in working order.....	22.05 pounds.
“ “ 5 positive plates.....	4.25 “
“ “ 6 negative “.....	2.32 “
Height of positive plate.....	11.02 inches.
Width “ “.....	4.92 “
Height of negative plate.....	11.81 “
Width “ “.....	4.92 “
Surface of positive.....	54.22 sq. m.
“ “ negative.....	58.10 “
Length of receptacle.....	5.90 inches.
Width “ “.....	3.35 “
Height “ “.....	15.75 “
Weight “ “.....	2.20 pounds.
Electrolyte (specific gravity, 1.55) weight.....	13.224 “
Useful electro-motive force.....	.75 volt.
Current, charging.....	.15 ampères.
“ “ discharging.....	.48 “
Time of charging.....	.30 hours.
“ “ discharging.....	9.5 “
Useful capacity.....	413 ampère hours.
“ “ “.....	.42 H.P. hours.
Capacity per pound of cell.....	18.72 ampère hours.
“ “ “.....	14.12 watt hours.
Weight per horse-power hour.....	52.47 pounds.

According to a note of M. Krebs, however, the total weight of battery for a horse-power hour was found to be 87.55 pounds.

THE EDISON ELECTRIC-LIGHTING SYSTEM IN BERLIN.—According to *Industries*, the work of the Edison Company in Berlin has been so successful that the public and the municipal authorities have perfect confidence in their ability to extend their central-station work still further, and a concession has been given for the establishment of two new stations. Both stations must be ready within two years, and each must be able to supply current for 6,000 glow-lamps burning simultaneously. The capacities of the two stations are to be eventually increased to 24,000 and 12,000 lamps. The network of cables to be laid down in connection with these stations is very complete, and practically comprises all the streets of the respective districts, some small side-streets alone excepted. In view of this extension of their business, the Edison Company propose to increase their share capital at present by \$750,000, and later on by \$1,500,000. The supply of current within the districts to be lighted will be compulsory, provided the customer is willing to take the light for at least one year.

THE EICKEMEYER DYNAMO.—The *Electrical Review* contains a description of a dynamo which has just been built by Mr. Eickemeyer, to be used in 'forming' the plates of storage-batteries. The novelty of this machine lies in the fact that both the armature and magnet coils are surrounded by a heavy casing of cast iron. The advantage of the type lies in the fact that there is no chance for lines of force to take any other path than through the armature, so that all magnetic leakage is avoided. The dynamo is to give 40 ampères at 1,000 volts. Its weight is 6,000 pounds, the principal part of which is in the cast-iron casing. The armature is of the drum type, 18 inches in diameter by 15 inches long. There are 240 turns of No. 11 wire, making a single layer on the armature.

The machine is shunt-wound, and the following data are given as to its performance:—

Armature.....	240 turns, 1,560 feet No. 11 wire.
“ resistance.....	0.57 ohms.
Field.....	14,880 turns, No. 21 wire.
“ resistance.....	1,600 ohms.
Speed.....	.850 revolutions.
Electro-motive force at terminals.....	1,000 volts.
“ “ “ per foot of wire.....	1.28 “
Current in external circuit.....	40 ampères.
“ “ field.....	.625 “
“ “ armature.....	40.625 “
Energy absorbed in field.....	612 watts.
“ “ armature.....	912 “
“ “ “ friction, etc.....	600 “
Net commercial efficiency.....	94.5 per cent.

The machine is said to run beautifully, with no sparking at full load. Its efficiency is more than good; and the dynamo is simple in construction, and cheap.

TRIAL OF AN ELECTRIC LOCOMOTIVE AT BIRMINGHAM, ENGLAND.—The following description of a trial of an electric locomotive is given in *Industries*: “The trial trip of an electric locomotive for drawing the tram-cars of the Birmingham Central Tramways Company took place in the presence of a large number of representatives of the press, the corporation, and of the various tramway companies. The engine itself, weighing eight tons and a half, has been constructed upon the Julien system by Messrs. Elwell-Parker. In the trial the electric locomotive successfully replaced the steam-tram engine now in use upon the Birmingham tramways. The gradients in many places are steep, rising to 1 in 17; but the electric locomotive successfully mounted this steep and long ascent with a load of sixty passengers, at a speed of about five miles an hour. On the level and down hill the speed could be increased to ten miles an hour without difficulty; and the locomotive was started, stopped, and backed with ease. The engine itself is a very neat and compact arrangement, compared with the ordinary tram-engines. Two rows of accumulators occupy each side, between which is the alley for the driver, where is fixed the switch, the reversing-switch, the engine-brake, and the car-brake. The switch connects the cells in five sets, all parallel, and two, three, or four in series. The cells number 104, having 39 plates, each 9 inches by 6 inches. The motor is placed low down, and is connected to the axles by helical gearing, — geared 1 to 8½. The engine is capable of exerting 40-horse power, and will run sixty or seventy miles. A contract has been entered into by the engineers to run this car for three months at twelve cents per car-mile, the present cost of steam being nearly sixteen cents.

ELECTRIC-LIGHTING.—The establishment of central stations for the distribution of incandescent electric-lighting has received a noticeable impetus through the successful introduction of the alternating current and transformer method of distribution. The saving in the cost of conductors effected by this method, due to the employment of relatively high potential currents in the mains, has rendered it commercially practicable to distribute over much larger areas than formerly, but over areas of relatively sparse consumption. Thus many small towns are enabled to maintain successfully electric-lighting stations. The Westinghouse Electric Company of Pittsburgh, Penn., introduced the alternating-current system here, after careful and thorough investigation and experiment, about two years ago, installing the first commercial station at Buffalo, N.Y., and putting it in operation Thanksgiving Day, 1886. The number of central-station plants since supplied or contracted for by the Westinghouse Company has reached no fewer than one hundred and twenty-four. They have recently received a contract for a station in the heart of London, to include an outfit for twenty-five thousand lamps. This contract is with the Metropolitan Electrical Supply Company, Limited, the organization of which in London was noticed in electrical journals some months since.

AN ELECTRIC SURFACE ROAD IN NEW YORK.—The Bentley-Knight Electric Railway Company will soon resume operations on the Fulton Street cross-town railway in this city, and expect to have it in operation before the end of this month. They began work on the road over a year ago, but, owing to the opposition of a

street-railway whose track extended over a part of the route, they were unable to proceed far with the work at that time. In the Bentley-Knight system the electric current is taken from conductors contained in and protected by sub-surface conduits, — a system admirably adapted to the crowded thoroughfares of a busy city.

COMMERCIAL GEOGRAPHY.

The Obi Railroad.

THE question of opening the interior of Siberia becomes more and more important. While hitherto the canals between the large rivers, and projects of navigating the dangerous Kara Sea, were foremost among the plans that seemed likely to be realized, the project of a railroad from the lower Obi to the coast west of Nova Zembla has at present assumed definite shape. The Russian newspapers give the following reports of the project: The Obi Railroad, the most northern road ever planned, will be of the greatest economic importance to Siberia. It deserves special attention, as the projectors do not demand any subsidy or government guaranties. The river Malaia-Obi, near Obdorsk, is the starting-point of the projected line, which will take a direction towards the foot-hills of the Ural Mountains. The latter will be crossed in one of the transversal valleys, which are not over one hundred feet above sea-level. It will cross the river Ussa near its source, and reach the ocean through the tundra of Bolchesemelsk. Its terminus will be in the Bay of Shainoudir, near Belcoff Nosse. The total length of the line will be 260 miles. The price of construction, including rolling stock, is estimated at forty thousand dollars, or ten million dollars the whole line. The establishment of a port on the Arctic Ocean in the locality mentioned above, with all modern improvements for loading and unloading vessels, is estimated at one and a half million dollars. To this must be added the cost of establishing a line of river-boats on the Obi and Irtysh, which is estimated at two and a half million dollars. Thus the whole plan requires the expenditure of fifteen million dollars in works of construction.

It is believed that the line can be worked for six months of the year. The products of the remotest parts of the Obi basin will be carried to the shipping port on the ocean in twelve days, while twelve days more will be sufficient to carry them to London. The price per hundredweight is estimated at \$1.30; while on the present route, *via* Barnaul, Perm, St. Petersburg, London, it is \$2.25, the time necessary to accomplish this distance being 130 days.

The railroad, which has been projected by Mr. Golovacheff, is intended as a means for making the transactions of a Siberian commercial company, which has been founded recently, profitable. According to the concession granted by the Russian Government, this road will not be open to the public, but will only be used by the grantee, who proposes to export the grain and stock from southern Siberia, and hopes to be able to furnish the London market with north Siberian fish. On the other hand, the company will import principally machinery, which so far has hardly found its way to Siberia, and other articles which are at present imported by Moscow merchants.

NOTES AND NEWS.

SCREENED from the world by a high fence, and not far from the Edison Laboratory at Orange, N.J., there have gone up two large factory-buildings. In these buildings there are now in operation a hundred thousand dollars' worth of such fine machinery as can be supplied by E. E. Garvin & Sons of New York, Pratt & Whitney and Dwight Slater of Hartford, and Brown & Sharpe of Providence, in the manufacture of the parts of the improved phonograph. The assembling of these will begin at an early date, so that by Jan. 1 one hundred phonographs should be leaving the works each day. Lieut. F. W. Toppa, U.S.N., is the manager.

— Lieut. D. Bruun of the Danish army, says *Nature*, having had a moss dug out in Finderup, in Jutland, has made some discoveries. In the moss were found trunks of oak, beech, and fir trees from 6 to 30 inches in diameter. The branches had in some cases been cut off, but the bark remained. By the side of one of the oak trunks two earthen vessels were discovered, and near another a third, shaped like an urn. In the latter lay a sandal cut from a

piece of leather, with flaps, and leather straps for tying to the ankle the length of the sandal being 7 inches. It seemed as if the trunks of trees had been placed in a certain position for some purpose or other. About 20 feet farther to the south, and at the same depth, viz., 6 feet, a yoke of oak was found, 5½ feet long and 3 inches thick, being fairly cylindrically cut out in the centre. At each end, were holes, in one of which remained a strap of leather. Other implements of oak were also found, evidently used for carrying. Some of them seemed part of a wheel. Close to the yoke another earthen urn was discovered, which, like the three referred to, was surrounded with sprigs of heather and bramble. Formerly some horns of bullocks and the skeleton of a man in a fur coating were found in the moss. The various objects are now in the Copenhagen Museum, and are said to date from the early iron age.

— Mr. J. W. Osborne of Washington, the well-known inventor of photo-lithography, has presented to the United States National Museum and to the Art Museum in Boston his large and exceedingly valuable collection of proofs and specimens illustrative of the development of photo-mechanical printing. All the important and typical processes are fully represented in each by specimens collected by Mr. Osborne in all the art centres of Europe and America, and include the works of all who have in any measure achieved success in the graphic arts. As soon as it can be properly classified, the collection intended for the National Museum will be placed on exhibition in the section of graphic arts. Mr. Osborne's contribution, the museum authorities assert, has laid a substantial foundation for an exhaustive collection of kindred productions under government auspices at Washington.

— The Philosophical Society of Washington will hold a meeting on Saturday evening, Dec. 8, at which an address will be delivered by the retiring president of the society, Col. Garrick Mallery, on 'Philosophy and Specialties.'

— According to news received in Denmark, Dr. F. Nansen has succeeded in crossing Greenland, but unfortunately was too late to catch the last steamer. It will be remembered that on July 15 Dr. Nansen, accompanied by Lieutenant Sverdrup, two other Scandinavians, and two Lapps, left the whaler 'Jason' in latitude 65° north, in sight of the east coast of Greenland. After twelve days of difficult march across the pack-ice, the coast was reached, but about sixty miles farther south than Dr. Nansen expected to land, the current having carried the ice southward. On Aug. 15 the party began the march across the inland ice, taking a north-westerly direction towards Christianshaab. When a height of about 7,000 feet was attained, the travellers were overtaken by a northerly snow-storm, which compelled them to take a westerly course toward Godhaab. The greatest altitude attained was about 9,500 feet. Finally, after forty-six days of travel, the party arrived at the head of Ameralik Fiord, which is situated a little south of Godhaab, and, by means of an improvised float, Godhaab was reached on Oct. 4. Dr. Nansen despatched immediately two kayaks with letters to Ivigtut, from which place the steamer 'Fox' was to leave about this time. The kayaks reached this place when the steamer was about to leave, and as the captain did not feel justified in delaying his departure, on account of the advanced season, the party will have to winter in Greenland.

— At the meeting of the Royal Meteorological Society held on Nov. 21, Mr. G. J. Symons read a paper entitled 'Results of an Investigation of the Phenomena of English Thunder-storms during the Years 1857-59.' This paper was written nearly thirty years ago. It has now been communicated to the society at the request of the thunder-storm committee. The paper contains a summary, chiefly in statistical form, of some of the results of an investigation into English thunder-storms, and the accidents produced by lightning during the years 1857-59. The author found that in sheet lightning the most prevalent color is white, then yellow, blue, and red; in forked lightning the order is nearly reversed, blue being more than twice as frequent as any other color, then red, white, and most rarely yellow. Sheet lightning was seen about twice as often as forked. Dr. A. Riggensbach exhibited some photographs of cirrus and other fine clouds, which had been obtained by using the surface of a lake as a polarizing mirror.

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THE GREAT EXTENT OF FORESTS in the State of New York, and their devastation, that has been going on continuously, have led to repeated endeavors to protect them from unlawful cutting-down and wasteful practices. For this purpose the New York State Forestry Association was founded in 1885, and did much to get the well-known forestry law passed by the Legislature. Since that time, however, the association has failed to show a vigorous life. At present renewed endeavors are being made to establish the association as a working body for the purpose of disseminating knowledge on the importance of forests, and for promoting measures to secure their proper protection. The New York Academy of Sciences devoted its meeting last Monday to this subject; and the proposed steps, which were explained by Professor Southwick of the New York State Forestry Association, found general indorsement in the discussion following Professor Southwick's remarks. The object is one of great economic importance to the State, and, as Dr. H. Nicholas Jarchow, the first speaker of the evening, remarked, the forests forming a portion of the public domain ought to be a source of considerable income instead of causing expense. He continued, "It would be very advantageous to establish a forestry school in or near the Adirondacks. Its cost would not be large, especially if adjoining States, having much the same climate and varieties of trees, would combine to support a school.

Moreover, the labors of the students would nearly pay expenses, and, once graduated, there would be a demand for their services from all parts of the country. Congress has made a national recommendation on the subject; but Congress is slow to act, and the States should provide for themselves in the matter. Trained foresters would take an honest pride in their work, and put their hearts in it. They would save valuable lumber, prevent great thefts of timber, and break up the present state of affairs, with all its disadvantages." Experience has shown that the last act of the Legislature, although a step in the right direction, has not the desired effect: therefore all measures taken for inducing the Legislature to organize a good forestry board, with ample means for carrying on its important work, and attempts to spread an intelligent knowledge of the importance of forests and of their economic value, must be highly welcomed. The New York Academy of Sciences has done well to bring the subject once more before the public, and it is to be hoped that the meeting will be of help to the attempted re-organization of the State Forestry Association.

BOOK-REVIEWS.

A Short Account of the History of Mathematics. By WALTER W. R. BALL. London and New York, Macmillan. 12°. \$2.60.

MR. BALL, who is a fellow and assistant tutor of Trinity College, Cambridge, offers in this compact volume a transcript of his lectures delivered in the spring of the present year on the history of mathematics. While technical and exact enough to be of value to the specialist in mathematics as a handy book of reference, it is so clearly and familiarly written, that it is the best work on this subject for the general reader that we know of.

The region of mathematics is a *terra incognita* to most persons, even those who consider themselves possessed of a good general education; and this, despite the fact that mathematics as a mental discipline is unsurpassed, and is unrivalled for the beauty and grandeur of its results. Having for its foundation the two universal and necessary forms of perception, space and time, mathematics developed, naturally enough, in the early stages of reflective thought. To trace the growth of its conceptions in clearness and perspicuity, and to follow up the increasingly complex and varied forms of symbolism, is the work of the history of the science, and Mr. Ball's treatment of it is eminently successful.

After a summary notice of what we may call the prehistoric period of the science, mathematics as understood and taught by the Egyptians and Phœnicians, the author makes a tripartite division of the subject,—mathematics under Greek influence, the mathematics of the middle ages and the renaissance, and modern mathematics. Of the first period, Pythagoras, Euclid, Archimedes, and Ptolemy are the most important representatives. The *quadrivium* of the mediæval schools is traced back to the division of knowledge adopted by the Pythagorians,—numbers absolute, or arithmetic; numbers applied, or music; magnitudes at rest, or geometry; magnitudes in motion, or astronomy. In a chapter on 'Systems of Numeration,' after the prominent names in this first period have been discussed in chronological order, Mr. Ball gives an interesting account of the early methods of counting, and the introduction of the abacus. In his mention of the use of this instrument, we should have been glad to find a more extended notice of the form of it in use among the Chinese, and some further explanation of the very complicated computations which they perform by its aid with great celerity and accuracy.

In the second period, most of the mathematicians were astronomers; but the period includes the introduction of Arabian mathematical works and the results of Arabian thought into Europe. In reference to this, Mr. Ball says, "It was from Spain, and not from Arabia, that Arabian mathematics came into western Europe. The Moors had established their rule in Spain in 747, and by the tenth or eleventh century had attained a high degree of civilization. Though their political relations with the caliphs at Bagdad were somewhat unfriendly, they gave a ready welcome to the works of the great Arabian mathematicians. In this way the Arab transla-

tions of Euclid, Archimedes, Ptolemy, and perhaps of other Greek writers, together with the works of the Arabian algebraists, were read and commented on at the three great Moorish universities or schools of Granada, Cordova, and Seville. It seems probable that these works represent the extent of Moorish learning; but, as all knowledge was jealously guarded from any Christians, it is impossible to speak with certainty either on this point or on that of the time when the Arab books were first introduced into Spain" (p. 157).

A good summary of the condition of mathematical knowledge at the close of the renaissance is given at p. 228: "By the beginning of the seventeenth century we may say that the fundamental principles of arithmetic, algebra, theory of equations, and trigonometry had been laid down, and the outlines of the subjects as we know them had been traced. It must, however, be remembered that there were no good elementary text-books on these subjects; and a knowledge of them was thus confined to those who could extract it from the ponderous treatises in which it lay buried. Though much of the modern algebraical and trigonometrical notation had been introduced, it was not familiar to mathematicians, nor was it even universally accepted; and it was not until the end of the seventeenth century that the language of the subject was definitely fixed. . . . If we turn to applied mathematics, we find, on the other hand, that the science of statics had made but little advance in the eighteen centuries that had elapsed since the time of Archimedes, while the foundations of dynamics were only laid by Galileo at the close of the sixteenth century. In fact, it was not until the time of Newton that the science of mechanics was placed on a satisfactory basis. The fundamental conceptions of mechanics are difficult, but the ignorance of the principles of the subject shown by the mathematicians of this time is greater than would have been anticipated from their knowledge of pure mathematics. With this exception, we may say that the principles of analytical geometry and of the infinitesimal calculus were needed before there was likely to be much further progress. The former was employed by Descartes in 1637; the latter was invented by Newton (and possibly independently by Leibnitz) some thirty or forty years later; and their introduction may be taken as marking the commencement of the period of the modern mathematics."

That which follows is more familiar, and the feature of Mr. Ball's chapters on the modern period is his full and clear analysis of Newton's contributions to mathematical science. Descartes, Pascal, Barrow, Huygens, Newton, Leibnitz, the Bernoullis, Euler, Lagrange, Laplace, Legendre, Poisson, and others less important, are treated in turn and with excellent judgment. Their successors are very briefly mentioned, and no attempt is made to follow out in detail the researches of Abel, Gauss, Sir William Rowan Hamilton, Henry J. S. Smith, Weierstrass, Cayley, Sylvester, and Klein. But from this history, or historical sketch, the intelligent reader can gain a very complete view of the progress of mathematical science from its beginnings until its contemporary differentiation into numerous specialties, — each of them important and difficult enough to detain for a lifetime a brilliant mind, — all of which are fruitful in their applications to the various phases of modern science and modern industry.

A Brief History of Greek Philosophy. By B. C. BURT. Boston, Ginn. 12°. \$1.25.

THIS work had its origin, the author tells us, in a series of articles in a religious newspaper, but has been expanded so as to cover the whole history of Greek speculation from Thales to Proclus. The result is a volume of three hundred pages, in which the leading doctrines of the various schools are concisely yet for the most part clearly presented. Mr. Burt's style is plainer than that of most writers of the school to which he belongs; and his readers will seldom have any difficulty in understanding what he says, except where the theories he is trying to explain are themselves obscure. The main fault in the book, according to our view, is the author's Hegelianism. This leads him not only to look in the ancient thinkers for anticipations of his own views, but also to give too much attention to some theories of the earlier philosophers and of the Neo-Platonists which can only be regarded as products of imagination. What we want to learn about the ancient philoso-

phers is their contributions to the real philosophies of the world; while their visionary theories, which they themselves in many cases put forth as only conjectural, ought to be passed over in silence, or with a bare mention. In the main, however, Mr. Burt has confined himself to the best portions of Greek thought, the great names of Socrates, Plato, and Aristotle necessarily occupying the foremost place, yet without excluding what is most important in the works of others. The exposition of Aristotle is excellent, though the treatise on 'Politics' is accorded rather too much attention; but the account of Plato is hardly so satisfactory. The author's view of the periods of Greek thought is essentially that now commonly held. The first period was that of naturalism, or the attempt to explain the physical world; the second, that of rationalism, or the endeavor to understand human nature and discover the basis of morals; while in the third or Neo-Platonic period theological speculation held the leading place. Of these different phases of thought, the second is so much the most important that the exposition of it rightly occupies the greater part of the volume; yet the others receive all the notice that is necessary in so compendious a treatise. Mr. Burt is careful also to trace the connection of each period with the preceding one, and also of one individual thinker with another, thus exhibiting the course of philosophical development. On the whole, the book is well adapted to its purpose, and will undoubtedly be useful to young students, in college and elsewhere, for whom it is more especially intended.

Paradoxes of a Philistine. By WILLIAM S. WALSH. Philadelphia, Lippincott. 16°. \$1.

THIS volume consists of a number of short essays, most of which had previously appeared in certain periodicals. The author remarks that the word 'paradox' "is usually held to be a synonyme for flippant smartness," but that it really means a proposition that seems absurd but is nevertheless true in fact. His own paradoxes, however, hardly answer to either of these definitions; for only a perverted intelligence could regard the mass of them as true, and, though they are flippant enough, we fail to see any 'smartness' in them. The book is a continuous sneer at men of genius and at intellectual and moral superiority of every kind. Mr. Walsh maintains that "men are more nearly equal than we suppose," and that "there is no such great difference between a genius and a dunce." "The great historian, the great poet, the great statesman, the great philosopher, . . . are as fallible and as foolish . . . as you and I are. The intellectual feats that they perform only happen to be more difficult to the average man, that is all." He endeavors to sustain this view by citing examples of follies and sins committed by men of genius; but most of the men he refers to were not geniuses at all, but commonplace men who followed the profession of literature. The author adopts a cynical tone throughout, which adds to the disagreeableness of what he says. Moreover, there is hardly any thing of a different character in the book, except some fantastic remarks on 'The Sense of Pre-existence,' and a few pages about 'Mother Goose.' Mr. Walsh says that he has collected these papers into a volume, "because the author likes them," and the world will probably be willing to grant him the exclusive enjoyment of them.

The Critical Period of American History. By JOHN FISKE. New York, Houghton, Mifflin, & Co. 12°. \$2.

THIS book consists of lectures delivered first in the Old South Meeting-House at Boston, and afterwards in other cities. It relates to the time between the close of the revolutionary war and the adoption of the Federal Constitution, which Mr. Fiske justly regards as the most important period in our national history. Our popular historians are apt to give altogether too much attention to wars and other stirring events, and too little to the quieter but more influential movements of political and constitutional reform. Mr. Fiske, however, has a much better idea of the historian's duty, and has accordingly given us a much better book than most of his predecessors have done. His philosophical studies have given him the comprehensiveness that good historical writing requires, and have fitted him to trace with clearness the chain of causes and effects which is the fundamental fact in historical development. His style, too, with its clear and easy flow, is well fitted for the

conveyance of historical truth, and never leaves the reader in doubt as to the author's meaning. The result of these qualities is that the book presents a large amount of information in a plain and easily understood form; and, though it contains a great many details, they appear in the main as essential parts of the narrative, and not as isolated and insignificant facts.

Mr. Fiske opens his work with an account of the negotiations for peace between Great Britain and the United States, and then goes on to describe the condition of the several States at the time, and the political changes that took place in them after the attainment of their independence. The most important parts of the book, however, are the third and fourth chapters, dealing with the general state of affairs in the years succeeding the peace, the alarming tendency towards anarchy, and the utter inadequacy of the Confederation to furnish a stable government. Mr. Fiske makes it perfectly clear, that, if things had been left to take their own course, the Confederation would in a short time have broken up, and that it was the gradual but sure perception of this fact that paved the way for a stronger central government. The prejudice at first existing against such a government was dissolved by the logic of events, and then the good sense and patriotism of the people came to the rescue. Such a Constitution as ours, however, could not have been framed except by men of the highest political genius, and even the soberest thinkers will not regard Mr. Fiske's encomiums upon them as exaggerated. In his account of the Federal Convention, however, the author seems to us to have given too little attention to what is really the essential feature of our system of government. The most vital and most original part of the Constitution is the division of powers between the State and the Federal governments, and it is also the most perfect part; yet Mr. Fiske has less to say about this part of the scheme than about any other. But there is little to criticise in the book, and we cannot but hope that its author will give us other works of a similar character, and that other historical writers will come more and more to follow the same method of treatment. The American people need all the political instruction they can obtain, and books dealing with history, as this book does, in a philosophical manner, are among the best of political teachers.

Astronomy with an Opera-Glass. By G. P. SERVISS. New York, Appleton. 8°. \$1.50.

THE greater part of the matter composing this volume appeared originally in a series of articles published in *The Popular Science Monthly*. The author points out the interesting phenomena of the heavenly bodies that are visible, with little assistance from optical instruments, and thus gives an interesting and valuable introduction to the study of astronomy. Although nothing has been described as visible that cannot readily be seen by means of an opera-glass or a small field-glass, enough of the discoveries made by means of powerful telescopes has been stated to lend due interest to the subject, and to instigate the observer to further studies. The book has been written for the purpose of being a guidance to the observer. For this reason the matter has been arranged according to objects visible in each season, the stars of spring, summer, autumn, and winter each being treated in one chapter. Observations of the moon, the planets, and the sun are described in the last chapter of the book. In an introduction the requirements of a good opera-glass are set forth. The work is well adapted to exciting interest in astronomy, and imparting such knowledge of the heavenly bodies as must form the foundation of intelligent study of the results obtained by means of powerful telescopes.

American Weather. By A. W. GREELY. New York, Dodd, Mead, & Co. 12°.

THE object of the present work is to give clearly and simply, without the use of mathematics, an idea of meteorology. The introductory chapters treat briefly the methods of measuring atmospheric pressure, temperature, and other meteorological phenomena, while the rest of the book is a detailed climatology of the United States. The various phenomena are fully discussed, and illustrated by numerous maps, which convey a peculiar interest to the book. The vast amount of material collected by means of the Signal Service and the State meteorological services has been made use of,

and makes the book a very complete and comprehensive review of the climatology of the United States. The work is not merely a compilation of the work of other authors, but General Greely frequently takes occasion to put forward his own views, particularly in the chapters on storm-tracks. The principal merit of the book is the concise and clear treatment of the matter, which will enable every one interested in meteorological phenomena to understand the peculiarities and diverse character of American climate in various parts of the country. We hope it will contribute towards creating a greater appreciation of meteorology, and of its importance to the interests of American agriculture and industries. Some of the maps are particularly well adapted to show these applications of meteorology: among them we mention the maps of first and last killing frosts and the maps showing continuance of mean daily temperatures above 32° and 50°. The book forms a handy volume. It is well printed and illustrated, and is an excellent treatise on American weather. In the clearness of its method, it may be compared to Mohn's well-known 'Elements.'

The Writer's Handbook. Philadelphia, Lippincott. 12°. \$2.50.

THIS book consists of three distinct parts, written apparently by three different writers. All the writers are evidently British; but who they are, nothing on the titlepage, or elsewhere in the book, enables us to say. The first part of the volume is an elementary treatise on composition and rhetoric, with a series of extracts illustrating the history of English style. The matter of this part is in the main good; though the author, like most rhetoricians, dwells too much on the merely mechanical qualities of style, and too little on the moral and intellectual ones. The subject of figurative language, too, is insufficiently treated, the important figures metonymy and synecdoche being wholly neglected. But the author's remarks on style, though covering but a portion of the ground, are pretty good as far as they go. They will not help the young writer much in acquiring the good qualities of style; but they will, if heeded, enable him to guard against many defects. The author's own style is not in all respects a model; for, though it is correct and clear, it has a certain mechanical character, and some paragraphs read like a succession of aphorisms. The samples of English prose are not always such as we should have chosen; for, though they illustrate fairly well the history of style, some of them are by no means models of good style, and for learners this latter consideration is the more important. The second part of the book is another treatise on composition, only one-third as long as the first, but superior in quality. It covers but a portion of the ground usually occupied by such works; the subject of figures, for instance, being omitted altogether. But it sketches in plain though brief terms the leading qualities of style, and gives some useful hints as to the best mode of acquiring them. The third and concluding part of the book is confined to the subject of letter-writing; and it seems rather out of place in this collection, for, though it may be useful to those who write nothing else than letters, it can hardly be of much service to those who have read the other parts of this book.

The Death-Blow to Spiritualism: being the True Story of the Fox Sisters as revealed by the Authority of Margaret Fox Kane and Catherine Fox Jencken. By REUBEN BRIGGS DAVENPORT. New York, G. W. Dillingham. 16°. 50 cents.

THE last phase in the sad but ridiculous story which this volume tells is perhaps the pleasantest, or, better, the least displeasing. Forty years after two mischievous girls in a lonely country house undertook to frighten their mother by a series of midnight tricks, the same girls, now as mature women, confess to the world that the unparalleled psychic epidemic to which their pranks gave rise is all a fraud. The raps interpreted by credulous folk as the answers of inquiries to departed spirits are nothing less homely than the dislocations of the great toe. Beginning these raps as children innocent of the uses to which they were put, spurred on to deeper and deeper mischief by the marked attention given to them by weak-willed believers and the money-making proclivities of an elder sister, they soon found themselves the centre of an ever-increasing throng of enthusiasts, and in a position where it was dif-

ficult to retract. From such slight beginnings arose this stupendous movement of Spiritualism, developing one after another of alleged communications with forbidden spirits; adding cabinet *stances*, materializations, second-sight, and a host of modified conjuring-tricks, as proofs of supernatural agency, — a complete systematization, in which mediums and phenomena were explained with an insane logic and a morbid imagination; and, worse than all, the pitiable deception of countless simple-minded folk upon matters nearest and dearest to them. To this tale of constant opposition between fanaticism and science, the many investigations showing the groundlessness of these claims, we can now add the free and full confession of fraud on the part of the originators. The two heroines of the story are certainly to be praised for this avowal; and their romantic but hardly admirable career contains no better action than this. But whether this is really "the death-blow to Spiritualism" must be questioned. Such movements die slowly. Its adherents will claim an evidence independent of the Fox sisters, and ascribe to the latter mean and suspicious motives. As a writer on such topics has well said, men go mad in crowds, but they return to their senses only slowly and one by one.

AMONG THE PUBLISHERS.

THE *Century* for December contains a number of full-page engravings of sacred pictures by the old and little-known Italian master, Duccio. A striking feature is furnished by two articles on Henry Ward Beecher's appearance in England in 1863, in advocacy of the cause of the American Union. But the two contributions having perhaps the highest importance are the instalment of the life of Lincoln, entitled 'First Plans for Emancipation,' and the paper by Mr. Kennan in which he graphically describes 'Life on the Great Siberian Road.' In this number are the first of the stories of Irish-American life, by Mr. George H. Jessop, and one of Mr. Cable's literary 'finds' in the way of strange true stories under the title of 'Françoise in Louisiana.' In the same number is a timely paper on 'The Re-organization of the British Empire,' by Mr. George R. Parkin. In connection with Mr. Parkin's article is an Open Letter entitled 'Home Rule and Culture,' on the Irish aspect of re-organization, by Mrs. Margaret F. Sullivan. Henry James writes with full knowledge and critical enthusiasm a paper of which the pregnant title is 'London,' which paper has a running accompaniment of drawings by the well-known artist, Joseph Pennell. Edward L. Wilson gives his personal observations on the route 'From Sinai to Shechem,' accompanied by fifteen illustrations drawn mainly from his photographs. The 'Topics of the Time' are 'Christmas,' 'Progress of Ballot Reform,' 'Should there be an Aristocracy of Criminals,' and 'A Confusion in American Party Names.' In 'Open Letters' Mr. Ernest H. Crosby, of the New York Legislature, writes on 'Political Corruption,' suggesting the "formation of an American society for the promotion of political honesty;" and others of the 'Open Letters' deal with the 'Woman's Work' question, 'The Holt Method of Teaching Music,' and 'Herbert Spencer.' — On Dec. 6 the *Independent* celebrated the completion of its fortieth year. Articles were printed from Dr. Richard S. Storrs, the only one of the original editors now living; by Henry C. Bowen, who is one of the two original proprietors now living; and by Dr. Samuel T. Spear, who was a contributor to the first number. — The supplement in *Harper's Weekly* of Dec. 1 contains an article on 'Blizzards, Cyclones, and Tornadoes,' with illustrations by W. H. Gibson and others. — The International News Company of Beekman Street have ready the Christmas numbers of the London *Chatterbox* and the London *Graphic*, the latter having two large-page colored supplements. Neither of these celebrated publications will disappoint the expectations of their great throngs of readers in all parts of the world. They are as good this year as ever. — *The Book Lover* is the title of an attractive monthly journal published by William Evarts Benjamin, 6 Astor Place, New York, of which the first issue is dated November. — *The Publishers' Weekly* says that a new feature in periodical magazines is announced in the *Magazine of Poetry*, a quarterly review, whose first number will be issued in January, 1889, — a magazine to be devoted exclusively to poetry and the study of poetry. Among the poets to be discussed in early numbers are

Mr. Stedman, Mrs. Louise Chandler Moulton, T. B. Aldrich, Mr. Stoddard, Lowell, Holmes, Whittier, Boyle O'Reilly, Edgar Fawcett, and Edith Thomas. — The *Political Science Quarterly* for December contains among its leading articles, 'A Study of the Influence of Socialism upon English Politics,' by William Clarke, an Oxford graduate and a London journalist; 'An Argument for Private Enterprise *versus* Public Business Management,' by Prof. Arthur T. Hadley; 'A Discussion of the Legality of Trusts,' by Prof. Theodore W. Dwight; 'An Analysis and Criticism of the Law of 1887, regulating the Electoral Count,' by Prof. John W. Burgess; 'An Account of the Practical Operation of the Official or State Ballot System in England,' by Mr. Edwin Goodby, a prominent Liberal politician; and 'A Summary of the Legal Questions which have arisen under the English Ballot Act,' by Mr. H. H. Asquith, M.P.

— The sixth and seventh instalments of Proctor's 'Old and New Astronomy' have been issued. The work continues to be full of interest. It is beautifully illustrated and printed. The present instalments treat of the phenomena of the sun, its corrugated surface, faculæ and spots, and the sun's surroundings. The last-mentioned part contains particularly illustrations of phenomena observed during total eclipses. In the latter half of the seventh instalment the description of the inferior planets is begun. We call particular attention to the beautiful plates, appended to the last instalment, showing a typical sunspot, a photograph of the sun, and of a total eclipse. — Hartleben's great atlas, 'Die Erde in Karten und Bildern,' is almost complete. Forty instalments have been issued, and only ten more remain to be published. The last numbers contain an interesting colonial map, and another of the whole continent of America. The maps are very clearly engraved, and the topography is very good. The accompanying text, which is profusely illustrated, treats of the geography of Africa. In the following instalments the Arctic regions will be treated. — Ticknor & Co. will publish Dec. 10 a work that will challenge the attention of the entire Christian world, Catholic or Protestant. This is the autobiography of the famous 'Nun of Kenmare' (Ireland), Sister M. Francis Clare (Cusack), whose services in the great Irish famine of 1879 are world-famous, and who is equally known and beloved for her long service of devotion and charity for the aid and elevation of working-girls. — There has recently been published a work entitled 'Handbook of Stenotypy, or Shorthand for the Type-writer,' being a formulated system of abbreviated orthography for the use of type-writers and others. By the use of the Roman letters and the numerals, with which all are familiar, and without any occasion whatever of possessing a knowledge of any system of shorthand writing, any operator, on any type-writing machine, may, by the use of stenotypy, systematized in this work, with but trifling study, practice only being requisite, become sufficiently competent to print from dictation directly on the machine, with a speed exceeding their ability at ordinary type-writing by thirty to fifty per cent. George Lane, 150 South Portland Avenue, Brooklyn, N.Y., is the address of the publisher. — Prof. Henry Allen Hazen has published a useful 'Hand-Book of Meteorological Tables,' which will be welcome to all meteorologists, being a collection of the best tables, in compact form, convenient for use, and at small cost. All tables relating to the same subject are placed together so far as possible. Thus the matter is divided into tables relating to temperature, pressure, humidity, and wind. Linear tables for converting measures form the next part of the book, while the last part contains miscellaneous tables. Among these, those for dividing by 29, 28, and 31, will be found particularly useful. In an appendix meteorological normals for the United States are given. The handiness of the volume will make it a welcome help to the working meteorologist. Unfortunately there are a number of misprints, which, however, will doubtlessly be corrected in a second edition. — Gen. C. W. Darling, corresponding secretary of the Oneida Historical Society at Utica, has compiled from manuscripts of public records a work which he entitles 'New Amsterdam, New Orange, New York.' It may be expected early next year, states the *Publishers' Weekly*. — Thomas Whittaker will publish shortly 'Stray Leaves of Literature,' by Frederick Saunders of the Astor Library. — The Forest and Stream Publishing Company announces

'Charley's Wonderful Journeys,' a new book by C. F. Amery. It belongs to the 'Alice in Wonderland' class of juveniles. — Rev. James B. Converse, Morristown, Tenn., has in press 'The Bible and Land,' which, in the opinion of some, will "utterly rout and annihilate the most pernicious of Henry George's theories." — "The Historical Society of Rhode Island," says Mr. S. S. Rider, in his *Providence Book-Notes*, "has issued a proposal for the publication of a map of the State, 'defining the territories of the Indian tribes, and the Indian names of localities therein, wherever they can be discovered.'" — The J. B. Lippincott Company have published Amelie Rives's 'The Quick or the Dead?' in book-form. Miss Rives has written a preface for this edition, in which she explains her purpose in writing the book, and answers her critics in a trenchant but good-natured manner. — D. Lothrop Company have published 'The Story of Louisiana,' by Maurice Thompson, the third volume in The Story of the States Series; 'Glimpses of Great Fields,' by Rev. J. A. Hall, designed to refute the materialistic theories of evolutionists; 'The Lost Earl, with other Poems and Tales in Verse,' twenty-one poems, narrative, satirical, imaginative, etc., by J. T. Trowbridge; 'The Story of the American Sailor,' from earliest times to the present, by Elbridge S. Brooks. — D. Appleton & Co. will publish early this month 'From Flag to Flag: a Woman's Experiences and Adventures in the South during the War, in Mexico, and in Cuba.' The author, Mrs. Eliza McHatton-Ripley, was the wife of a planter in Louisiana. They will also publish a book on Florida, by Prof. James Wood Davidson, bearing the title 'Florida of To-Day: a Guide for Tourists and Settlers;' a posthumous work by Dr. W. B. Carpenter, entitled 'Nature and Man: Essays Scientific and Philosophical,' accompanied by a memoir written by J. E. Carpenter; an entirely new edition of Darwin's 'Origin of Species,' reprinted from the sixth and last London edition, which contains the author's latest revisions; and, in Appletons' Town and Country Library, a novel by Helen Kendrick Johnson, entitled 'Raleigh Westgate; or, Epimenides in Maine;' and a translation of Ernest Daudet's powerful novel, 'The Apostate.' — Lee & Shepard have ready 'The Julia Ward Howe Birthday-Book,' edited by her daughter, Laura E. Richards; 'Aryans, Semites, and Jews, Jehovah and the Christ: a Record of Spiritual Advance from the Household or Personal God of the Semite Abram, and from Jehovah, the Tutelary or National God of the Israelites, to the Universal Father revealed by Jesus the Christ, with the Contracts made between the Household God and Abram, the Tutelary God Jehovah and the Israelites, and between "Our Father in Heaven" and all Mankind, also the Circumstances, Incidents, and Events attending the Preparation and Promulgation of the Second Revelation,' by an anonymous writer; 'Essays, Religious, Social, Political,' by David Atwood Wasson, with a biographical sketch by O. B. Frothingham; 'The Apostle of Burma,' a missionary epic commemorative of the centennial of the birth of Adoniram Judson, by William C. Richards; 'Incidents of a Collector's Rambles in Australia, New Zealand, and New Guinea,' by Sherman F. Denton, artist of the United States Fish Commission, Washington, D.C., with illustrations by the author; and 'Free Trade,' a speech delivered before the Democratic Club, Brussels, Belgium, Jan. 9, 1848, with extract from 'La Misère de la Philosophie,' by Karl Marx, translated into English by Florence Kelley Wischnewsky, with preface by Frederick Engels. — Henry Holt & Co. are about to issue Sir Henry Maine's posthumous work on international law, which was in manuscript almost ready for the printers at the time of its author's death. The sheets have been seen through the press by Frederic Harrison and Frederic Pollock, two of Sir Henry Maine's executors. — Charles Scribner's Sons announce that the date of the publication of their edition of Paul du Chaillu's 'Viking Age' has been postponed in consequence of the time required to manufacture a work of such magnitude. The illustrations will number over 1,200. — The biography of John Stuart Mill by Mr. Courtney in the Great Writers Series will be published this month, and will contain a letter from Mr. Gladstone on Mill's career in Parliament. — Professor Sayce of Oxford has gone to Cairo for the purpose of copying the cuneiform tablets which have been collected there. — "A curiosity in the way of a dictionary," says the Boston *Traveller*, "has just been published by the Canadian Government. It is one of the

Micmac language by Rev. S. T. Rand, D.D., of Hantsport, N.S. The aboriginal languages of North America have long been recognized by European philologists to be among the most perfect linguistic systems that are known; and among the Algonquin languages none is more perfect than that of the Micmacs, once a powerful body in that great ethnical division. Heretofore, however, there has been a great difficulty in studying these languages, because of the lack of aids, such as grammars and dictionaries, which are both supplied in Dr. Rand's work, so that the importance of the work to scholars will be evident." — Worthington Company announce Ida Waugh's great artistic effort in a juvenile book, 'Bonny Bairns,' with 48 large quarto illustrations, every page in colors. The text is by Miss Amy Blanchard. This book by Miss Ida Waugh, author of 'Wee Babies,' and other popular books for children, will greatly excel in interest any book hitherto made by her. However beautiful her other books may have been, this will be found to be of more general interest than any of her previous works. — The December number (No. 39) of the Riverside Literature Series (published monthly at 15 cents a number by Houghton, Mifflin, & Co., Boston) contains four carefully annotated papers by James Russell Lowell, — 'Books and Libraries,' 'Emerson, the Lecturer,' 'Keats,' and 'Don Quixote.' 'Books and Libraries' is an address delivered in 1885 at the opening of a free public library. It is of especial value to book-lovers, and a most valuable aid to those interested in collecting books for private or public use. 'Emerson, the Lecturer,' a delightful paper on the sage of Concord, is of great interest to lovers of Emerson, and forms a most helpful introduction to his works. The chapter on Keats is a charming biographical and critical sketch of one poet by another. 'Don Quixote,' a paper read before a workingmen's college at London, is a very entertaining essay on the worth and place of imaginative works in literature. This number of the Riverside Literature Series places within the reach of all a choice collection of complete selections from the works of a master of English prose. It is especially suitable for use in high schools and academies. — The publishers of Worcester's Dictionaries, the J. B. Lippincott Company of Philadelphia, call special attention to the entirely new edition of their 'Academic Dictionary.' The 'New Academic' presents as a distinctive new feature the etymology of words. In this respect no other work of its class approaches it in fulness and completeness. In orthography great attention has been paid to usage, analogy, and etymology in deciding all disputable points. In pronunciation the book not only gives the preference of Dr. Worcester, but exhibits at the same time that of all the leading lexicographers. — An interesting sketch entitled 'The New Africa' has been published by the Rev. Lansing Taylor. The pamphlet embraces a series of articles which have appeared in the *Methodist Review*. An interesting outline of the most recent exploration of Africa is given, particular stress being laid upon Stanley's work. The author gives a vivid picture of what he calls 'the three Kongos,' the Kongo, Welle, and Kasai, and finally attempts to draw the curtain from the unknown future of this vast and fertile region. He sees it crossed by railroads and canals, inhabited by an industrious Christian population, and taking an active part in shaping the fates of the world. The author takes the most hopeful view in regard to the rapidity of the progress of this region, and its aptitude for becoming a home for Europeans, and impresses the reader with his enthusiasm. It is to be feared that the opening of Africa will not be so rapid and easy a matter as the author wishes us to believe. — The author of 'The Battle of the Swash,' which satirizes the American navy, is said to be James Barton, a nephew of the late Commodore Vanderbilt, and well known years ago in Wall Street. — One of the rare books in American history is known as 'Loudon's Indian Wars.' The full title reads as follows: "A Selection of some of the most interesting Narratives of Outrages, Committed by the Indians, in Their Wars with the White People. Also, An Account of their Manners, Customs, Traditions, Religious Sentiments, Modes of Warfare, Military Tactics, Discipline and Encampments, Treatment of Prisoners, etc., which are better Explained, and more Minutely Related, than has been heretofore done, by any other Author on that subject. Many of the Articles have never before appeared in print. The whole compiled from the best Authorities, By Archibald Loudon." It fills two small 12mo volumes

of only 724 pages, all told. The imprints read, "Carlisle: From the Press of A. Loudon (Whitehill) 1808," and "Carlisle: From the Press of Archibald Loudon, 1811." Of this book the Harrisburg Publishing Company proposes to reproduce an edition, limited to one hundred copies, for subscribers, at ten dollars per set. Subscriptions sent to Charles L. Woodward, 78 Nassau Street, New York, will be numbered, and will be good until the list is full. — Mr. Charles T. Strauss has published a condensed translation of 'Spelin,' a universal language, by Prof. George Bauer. The character of this new language may be understood from its name, which is derived from *s* (the prefix designating 'collectiveness'), *pe* (meaning 'all') and *lin* ('language'). It is founded on principles similar to those of Volapük, but is claimed to be more euphonious, and simpler. — The Second Geological Survey of Pennsylvania has just published the second part of the 'Atlas of the Eastern Middle Anthracite Field.' This part contains eight sheets relating to portions of the Lehigh basins in Luzerne, Carbon, and Schuylkill Counties. The cross-sections contained in this part form portions of a series begun in the first part, and to be continued in a third instalment.

— From a reading of Darwin's biography, an Englishman has compiled the following list of authors and books which Darwin mentions as having given him the most pleasure and stimulus: Thompson's 'Seasons,' Byron, Scott, Shakspeare, 'The Wonders of the World,' White's 'Selborne,' Reynold's 'Discourses,' Humboldt's 'Personal Narrative,' Herschel's 'Introduction to the Study of Natural Philosophy,' Wordsworth, Coleridge, Milton's 'Paradise Lost,' Gray, Shelley, Scott's novels, Miss Austen, Mrs. Gaskell, George Eliot's 'Silas Marner,' and Tennyson's 'Enoch Arden.' It was White's 'Selborne' that first set him to watch the habits of birds, and Humboldt and Herschel who first "stirred up in me a burning zeal to add even the most humble contribution to the noble structure of natural science."

— The importance of the study of dialects and mixed languages is well appreciated nowadays, and essays on these subjects are fortunately becoming more numerous. The Canadian Institute of Toronto is paying considerable attention to the French dialect of Canada, as its recent numbers show; and studies of the Negro French of Louisiana have been published in the *Journal of American Folk-Lore*. The tenth bulletin of the Portuguese Geographical Society contains a very interesting study of this character, — a grammar and vocabulary of the Portuguese dialect of the Cape Verde Islands, by A. de Paulo Brito, edited by the well-known student of the Romance languages, A. Coelho. One of the most interesting features of this study is a list of proverbs, conundrums, and songs. Among the latter we mention the 'batuque,' a series of improvised songs sung at certain entertainments. A group of young men and women form a circle around a fiddler, beating time by clapping their hands, singing at the same time. Suddenly one of the group improvises a verse, which he or she sings, joined later on by the chorus. It is a matter of congratulation that studies of this character become more numerous, as the levelling influence of civilization sweeps away the remains of ancient lore and ancient customs.

— The Clarendon Press has added to its list of valuable books 'A Class Book of Elementary Chemistry,' by W. W. Fisher. The author has attempted nothing especially novel in the scheme of his book, but has given as briefly as possible some account of the most important chemical phenomena, actions, and changes, with the laws of chemical combination and the theoretical explanations of those laws commonly accepted. The book will prove a valuable textbook for high school or college.

— The fourth part of J. Macoun's 'Catalogue of Canadian Plants' has just been issued by the Geological and Natural History Survey of Canada. It forms the first part of the second volume of this valuable work, and contains the *Endogens*. The foregoing parts were issued in 1883, 1884, and 1886 respectively, and include the *Polypetala*, *Gamopetala*, *Apetala*, and *Gymnosperms*. Since the publication of the third part, extensive collections have been made by James M. Macoun on the shores and islands of James Bay, by the author on Vancouver Island, and by Dr. G. M. Dawson on the

upper Yukon on his great expedition. That part of this additional information which is applicable to the *Endogens* is included in the present part. The work will be completed by two further parts treating the cryptogamous plants.

— C. Wellman Parks, Rensselaer Polytechnic Institute, Troy, N.Y., has undertaken the preparation of an exhibit of American periodicals for the Paris Exposition of 1889, and requests help to make it complete. He will provide wall space for copies of the various publications and group photographs of the editorial staffs, and tables and chairs for the use of those who care to examine the periodicals. Publishers are requested to send their publications to him in Paris as soon as issued, that the latest possible number may always be on file.

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Pseudo-scientific Humbuggery.

THE more mysterious a thing is, the more do ignorant people think they know about it. The learned man alone recognizes the limitations of his knowledge. On our maps the thoroughly explored regions have strict boundaries: only the *terra incognita* shade off into infinity.

Now, of all the uncertain subjects at present passing under scientific scrutiny, the etiology of infectious and contagious diseases is probably the most occult; but, for this very reason, it offers irresistible attraction to all sorts of rash theorizers. At the same time, the excitement occasioned by the visit of an awful plague, like yellow-fever, discloses a ready soil of credulity for the reception of every wild dogma, and starts into life the germs of superstition everywhere lying dormant in men's mental substratum.

If you care to see how charlatans take advantage of such a concatenation of circumstances, you have only to walk through upper Broadway, and drop in at the headquarters of a certain 'microbe-killer,' which you will have no difficulty in finding. Even if the proprietor's explanation of his wonderful invention does not strike you as being altogether lucid and ingenuous, you will surely be impressed with his apparent knowledge of and faith in human nature, as shown in the certainty with which he reckons upon a paying market for his extraordinary nostrum. This is evinced also by the fact of his occupying a conspicuous place of business, for which I suppose he has paid a good rent, and, perhaps even more indisputably, by his having risked the expense of a two-column advertisement in one of the daily papers a few weeks ago. The astonishing effrontery of that advertisement is manifested, not only in the ingenious nonsense put forth as a history of the alleged discovery, but also in the impressive pictures with which the highly imaginative article is adorned. These profess to be likenesses of the "deadly microbes" for which the infallible "killer" has been providentially provided. Of course, there is not a microbe among them. They are, however, with one exception, rude reproductions of photographs of diatom valves. The exception is a representation of a part of the tracheal system of a butterfly or moth.

This use of diatoms as catch-penny wonder-workers is nothing new. Some years ago, an enterprising genius conceived the brilliant idea, that, if wheat or any other cereal were fed with diatomaceous earth, the plant would take up the siliceous shells bodily and build them into its cuticle with great economy of energy. Accordingly he "invented" a fertilizer, which was extensively advertised, both here and in Europe; and into his advertisements he too introduced drawings. These claimed to show diatoms, not as they existed in his fossiliferous fertilizer, but as they were said to have been obtained from the cuticle of straw by the disintegrating action of nitric acid. But in his illustrative plate he was so indiscreet as to figure not only siliceous diatom-valves, which would withstand the power of acid, but also a certain entire diatom in a form in which it could exist only in a living state, with its soft and perishable envelope in place; and to these he had added sponge-spicules

and other objects not diatomaceous, and even a calcareous foraminifer. Notwithstanding these little discrepancies, the fertilizer received gratuitous indorsement from several of the leading scientific journals of England and America. In one of the latter a college professor gave it a splendid "send-off" in an article of very learned appearance, entitled 'Silica of Grasses and other Plants carried up as Diatoms or other Siliceous Grains, and not in Solution or as Soluble Silicates,' which was accompanied by the paradoxical plate above referred to.

In the cases I have mentioned, both the wholly uninformed masses and the broadly educated few were confidently calculated upon as easy victims to fraud when the recognition of some of the commonest of microscopic forms was involved. Diatoms exist on every hand, and, in both the living and the fossil state, are among the most plentiful of organisms; their indestructible remains constituting strata from three to thirty feet thick, extending through several of our seaboard States, while any Croton-water faucet will, in a moment or two, furnish abundance of living specimens of wonderful interest and attractiveness. Besides this, they have a considerable commercial importance, at least one New York firm making a trade specialty of the diatomaceous earths and the silicates made from them. And yet only a few weeks ago one of our daily journals devoted valuable space to sarcastic editorial comment on the examination papers used in the College of the City of New York, because they contained the supposed impractical and nonsensical question, "What is a diatom?" It now seems that it would be money in the pockets of some poor invalids if they only knew the difference between a diatom and a microbe.

It is the greatest shame of these impositions under the guise of science that professional men of some reputation at times lend them their countenance and aid. And, even when the thing recommended is not itself fraudulent, the mode of indorsing it often becomes so. An example of this came under my notice not long ago, when, in looking over a newspaper, my eye was caught by the word 'microscopical' occurring in a rather prominent advertisement of a certain soap, and upon examination I found that a gentleman of scientific claims had undertaken to give a certificate to the merits of the article advertised. Now, soap seems to be a thing about which comparatively little can be said from a sanitary point of view, except that a free use of it is desirable. But in the testimonial of which I am speaking there was manifested a wide-awake disposition to make the most of the passing public interest in infection and contagion. With remarkably lame logic, the scientific attorney of the manufacturer declared, in substance, that, having submitted the soap to microscopical examination, and having found it free from disease-germs, he was prepared to recommend it for its detergent qualities.

While we do not wonder to see a Wiggins rush forward, upon the very slightest excuse, as he did but lately, with a sixteenth-century astrological theory of yellow-fever, we cannot but feel both astonishment and mortification when a good chemist publicly dispenses bad microscopy, or an eminent physicist plunges headlong into hygiene and therapeutics, as one did the other day. A man may have almost superhuman insight as to the laws of electricity and yet be as ignorant as the rest of us about the how and why of a bacillus or a spirillum. It was not very strange that a gentleman hitherto absorbed in physics and mechanics should prove to be uninformed as to the unsuccessful endeavors that had been made to isolate and identify the microbe of yellow-fever, for he had come across lots into a scientific region of which the literature and even the language was unfamiliar to him. For the same reason, how was he to know that what would kill an ant would not necessarily kill a bacterium or a vibrio?

The trouble is, that a large part of the people who are most ready to discuss the new phase of biological science have not the faintest idea of what a microbe is. Most of them seem to fancy that merely a new name has been invented for what used to be called a spore or a germ; and of course every one knows what a germ is, for he has only to look at the seed of any well-known plant! This seems to be the difficulty with a famous military commander who has recently taken up the weapon more powerful than the sword, and, by means of it, given to the world, through one of our magazines, his *a priori* exposition of the mode of origin and spread of epidemic

diseases. He may fairly claim experience in keeping yellow-fever out of a community, but, after reading his article, we may well doubt whether he really has much information as to how it gets in.

In short, pseudo-scientific humbuggery is very prevalent just now; but I suppose we may console ourselves by regarding it as a popular tribute to the worth of true science, since we are told that "hypocrisy is a sort of homage that vice pays to virtue."

CHARLES F. COX.

New York, Nov. 20.

New York Archæology.

THE Bureau of Ethnology has been doing some work in western and central New York, the results of which will soon appear; but researches quite as important and exhaustive have long been going on without public aid. If the State, or individuals in it, would take the lively interest in preserving accounts of its perishing antiquities that is shown in other things, valuable results would be certain to follow. In carrying on my own investigations, I have been surprised to see how many are working in various places on similar lines, and in the way of comparison these quiet seekers have helped me much.

The leading feature in all this is the connection of relics with sites. All use maps; and on these all local sites are indicated, and a record is made of their extent and character. All articles are numbered or labelled with reference to these sites, so that the cabinet generally shows whence the relic came. This is not always possible, but in most cases it can be done. A good antiquarian who has thrown unexpected light on one group of sites has but one arm, and yet makes drawings of the more interesting forms. I draw and describe all in my own collection, and obtain figures of large numbers of those in others. Without such a comparison, I could not have arrived at some sound conclusions.

•In all these cases precision has been aimed at, and the general agreement is the more surprising when we find there has been no consultation in the matter. A large county map or atlas is used for the sites, when it can be had; and this allows of an exact record of the town, lot, farm, and even part of a farm, when desired. In making records, however, the Smithsonian code of signs is almost useless in New York, and is very little employed. The historical societies aid a good deal in the preservation of relics, but there is less aid to the scientist from their collections than might be expected. A few articles are labelled in a general way, sometimes very oddly; but care is seldom taken to connect them with the sites from which they came. Their value would often be tenfold greater were this done. It should therefore be urged upon all societies and individuals to make records of sites and relics in this way.

For scientific purposes there is frequently a deficiency in the collection of the ruder articles, as flat sinkers, chipped celts, grooved and hammer stones, but in a number of instances care has been taken of these also. Some of these are still in use in New York. It is well known, however, that some common articles in other parts of the land are very uncommon here. This is the case with the grooved axes; and the absence of early small wampum west of the Hudson River is so noticeable, that I quite agree with early writers in their statement that it was little used until the Dutch made it.

A collection of sites and relics has thrown much light on the early Indian migrations in northern and western New York, bringing out curious facts in regard to the routes chosen and the origin of the travellers or residents. It has dispelled much of the vagueness attending the occupation of the Iroquois territory, and enabled us definitely to connect historic with prehistoric times. That the facts brought out by field-workers have not always agreed with the theories of students is not surprising, but theories must always be regarded as but a temporary convenience.

In connection with this, I may call attention to a branch of ethnology which needs speedy attention, and has already received some. New York embraces within its limits a portion of the noted Six Nations, who still preserve some of their old customs, ornaments, and implements; but all who frequently visit their reservations are aware how rapidly the old is giving place to the new. To gather up the fragments is all that we can now do. Whoever un-

dertakes this work must remember, that, while all had much in common, these nations had an independent character, and that their laws, clans, feasts, traditions, and language varied greatly. Morgan's valuable 'League of the Iroquois' was a good account of the modern Senecas. Any one would be misled in applying it strictly to the Onondagas. Each nation, therefore, is worthy of independent study. If some competent person, conveniently near, would undertake this for each reservation, the results would be of great value.

W. M. BEAUCHAMP.

Baldwinsville, N.Y., Nov. 12.

Species and Subspecies: A Reply to Mr. Conn.

IN *Science* of May 25, 1888 (pp. 253, 254), Mr. H. W. Conn reiterates a belief, held in common by Romanes and himself, that there is a fundamental difference between what he calls 'varieties' and 'species.' The term 'variety' is objectionable on the ground that it is susceptible of several meanings, and consequently may be understood differently by different persons. It may be assumed that the word is used by Mr. Conn in the sense in which naturalists employ the term 'subspecies,' or 'geographical race.'

Mr. Conn says, "There is no question in biology more significant, or more difficult to answer, than what constitutes a species. Upon the answer hinges the question of evolution, and more particularly the theories of Darwin. In spite of an immense amount of discussion, no answer has ever been given to the question which is in any degree satisfactory."

The above statement demonstrates the ignorance of its author in matters well understood by those who handle species, and may be taken as an illustration of the results of the methods of teaching biology now employed in our leading schools, where systematic biology is entirely lost sight of in the effort to impress upon the student the superior importance of morphology, histology, and embryology: in other words, the student is encouraged to turn his back to the broad field of nature, and to open his eyes only to peer into the contracted field of the microscope.

Systematic naturalists — those who have to do with the interrelations of existing forms of life — do not experience the difficulty mentioned by Mr. Conn in defining "what constitutes a species," and are forced to protest against his statement that "no answer has ever been given to the question which is in any degree satisfactory."

A species is a group of individuals which resemble one another in all essential respects, varying only within certain definable limits, and which is separated from all similar groups by a well-marked hiatus. A subspecies or geographical race differs from a species in one respect only; namely, that intergrades exist connecting it with the parent stock: in other words, a subspecies is nothing more nor less than an incipient species.

Mr. Conn holds that 'varieties' are the result of variations in structure outside of the reproductive organs, while 'species' result from changes in the reproductive organs themselves. He says, "Variety and species are therefore independent, being founded on different kinds of variation." This hypothesis, it seems to me, is in its very inception a contradiction of the genius of evolution.

All forms of life inherit two tendencies, — one to reproduce exactly the characteristics of their ancestors, the other to vary therefrom. Variation is the result of one or the other of two sets of causes: namely, (1) the influence of climatic or other physiographic conditions; (2) the accidental or sporadic acquirement of a character which benefits its possessor, and hence is likely to be perpetuated, and increased from generation to generation. In order to clearly understand the laws of evolution, it is necessary to discriminate between these two kinds of variation. In variation resulting from the spontaneous acquirement of a beneficial character, the line of evolution is geographically stationary, but is ascending in time. Natural selection is the cause of this form of evolution; for the excess of individuals resulting from normal reproduction brings about a struggle for existence, and the law of "the survival of the fittest" results in the extermination of the parent form and the successive intermediate stages, so that the modified form and its ancestors are not in existence at any one period of time: in other words, the line of descent must be looked for in the history of the past, among strata containing paleontologic remains. On

the other hand, evolution due to geographic position — environmental evolution — may present all intermediate stages at the same time; the extremes, which we call subspecies, being found at distances remote from the centre of distribution of the type. Hence in the study of evolution it must be constantly borne in mind that there is this essential difference between 'geographic variation' and 'variation by natural selection:' that in the one case intergrades exist, in the other case they have become extinct during the process of differentiation.

Variation often takes place in more than one direction, producing several lines of differentiation which radiate from a common centre. In such cases there will be several peripheral forms which may differ from one another more markedly than each differs from the parent or central type.

In environmental variation the intermediate forms which connect the extremes with the central type, or with one another, are termed 'intergrades,' the peripheral forms being recognized as subspecies. The term 'peripheral' is here used in a geographical sense, implying that the individuals showing the peculiarity are found at points remote from the centre of distribution of the type.

It often happens that subspecies differ from one another and from the parent stock as greatly as species themselves. It sometimes happens, also, that in the course of time the forms inhabiting the intermediate region cease to exist, in which case the peripheral forms previously known as subspecies become species at once, without waiting for any further change; the only difference between species and subspecies being, as already stated, that in one case the intergrades exist, in the other they have become extinct.

C. HART MERRIAM.

Washington, D.C., Dec. 1.

Rosenbusch's Petrography.

YOUR reviewer, in his recent notice in your columns of Mr. Iddings's admirable translation and abridgment of the first volume of Rosenbusch's 'Mikroskopische Physiographie,' seems to me to have hardly apprehended the exact aim of this work. Inasmuch as the review, while not altogether unfair in its statements, may by its general tone convey the impression to those unacquainted with petrography that they are losing in the translation many essential features of the original manual, I beg leave to give the results of my own experience in the practical use of both books for purposes of instruction in a petrographical laboratory.

Heretofore the only available manual for the use of beginners in petrography has been Rosenbusch in the original; and every teacher, even in Germany, must have felt that for this purpose the book is somewhat cumbersome. My own experience has been that the mass of detail, however advantageous and necessary to the advanced worker, caused a loss of interest to students who were beginning the subject, even when they belonged to a superior class and possessed a tolerable knowledge of German. Those who, from an intimate acquaintance with Professor Rosenbusch's treatise, realized its great value, were loath to recommend even to beginners any other guide; and yet the need has long been felt of a translation which should present all the essential features of the work in English, without the mass of detail unnecessary for those taking their first steps in petrography. This need the translator has set before himself to fill, and in my opinion he has accomplished the task in a most judicious and satisfactory manner. Since the appearance of his translation a few weeks since, I have used it in my laboratory with a success which I had begun to despair of ever attaining with the original. Nothing really essential has been omitted, while the book has been reduced to nearly half its former size. The colored plate could be of no practical use to beginners, but would have increased the price of the work very considerably.

In his own preface the translator states that he has had no expectation or desire to supplant the use of the original. No student would dare to venture upon original investigation in petrography without a knowledge of German sufficient to enable him to read with ease the work in its extended form. To advanced workers Rosenbusch will be now, as ever, a vast treasure-house of information, which no abridgment of the translation will in any way curtail.

GEORGE H. WILLIAMS.

Baltimore, Nov. 30.

A Correction.

In last week's *Science*, p. 256, first column, line 40, occurs a typographical error which it may be worth while to correct. I refer to the word 'eidography,' erroneously printed 'cidography,'—a word suggested as useful in discussing surveys, and having reference solely to the surface form of the earth, its ups and downs, its hills and hollows. The words 'hypsography' and 'topography' are each used for this purpose; but the first refers rather to elevation than to form, and 'topography' has been and is used in different senses, hence its meaning is uncertain until defined by the writer using it.

MARCUS BAKER.

Washington, D.C., Dec. 4.

Queries.

39. WHAT IS THE ORIGIN OF FISH IN ISOLATED PONDS?—The Peninsula of Florida contains innumerable isolated ponds varying from a few square rods to many square miles in area. Many of these are simple hollows filled with rain-water, without any connection with other waters. Some of them are on high ground, where no flood can establish temporary connection with other waters, through which fish might be admitted. The smaller ones often dry up entirely in seasons of drought, yet when filled with water they do not seem to be behind their neighbors in population. They all swarm with fish, whose origin and continued presence would seem to present an interesting question. For instance: at Orange Heights, in Eastern Alachua County, which is one of the most elevated regions of the State, as is plainly shown by the radiating streams which rise in that vicinity, there is a small pond on top of the highest elevation in all that region. I have twice known this pond to be dry, yet it now contains an abundance

of small fish. How have they been preserved from destruction, and whence came the original stock?

CHS. B. PALMER.

Columbus, O., Nov. 20.

40. FELSPAR, OR FELDSPAR?—Will you or some one of your numerous correspondents kindly inform me which is the more correct designation, 'felspar' or 'feldspar'? Both forms are in common use among mineralogists, and most dictionaries give both. Phillips, in his 'Elementary Mineralogy,' 1823, gives 'felspar' in the text, and in a footnote 'feldspar,' from the German *feldspath*, adding, "perhaps because found on the surface of some parts of the country." Might it not rather be derived from the German *fels*, 'a rock'? If one knew when and how it was first used, this might solve the point.

J. THORBURN.

Ottawa, Can., Nov. 29.

41. THE "SUPERNUMERARY MOLAR" IN MAN.—Not many days ago there was a very excellent young dentist at work at Fort Wingate, N. Mex., and while there a white man of some thirty-five years of age presented himself to have extracted what he termed "an extra tooth" in his upper jaw. Happening in, I saw this rare anatomical structure immediately after its removal. It was a small, transversely ellipsoidal tooth, with a single, conical, peg-like fang, the tooth itself having developed at its buccal aspect a small additional cusp. This tooth was situated directly posterior to the upper wisdom tooth or last molar of the left side, and in contact with it. I am aware that this rare supernumerary molar in man is alluded to in the more extensive works upon dentistry, but I would be glad if some reader of this notice will inform me where I may find the best biological account of this structure in man, as well as its significance, and whether it has ever been observed in any of the *Simiina*.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Dec. 1.

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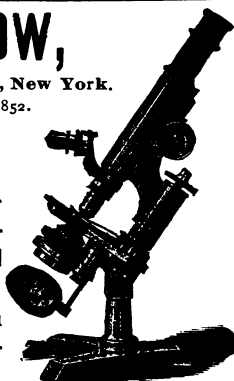
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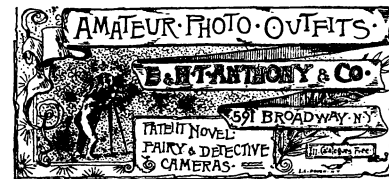
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